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ON THE PRESENCE OF TRITON SPECIES (*CHARONIA* spp.) (MOLLUSCA GASTROPODA) IN THE MEDITERRANEAN SEA: ECOLOGICAL CONSIDERATIONS (***)

KEY WORDS: tritons, Mediterranean Sea, distribution, Gulf of Naples, catching, ecology

Abstract

Of the two species of *Charonia* living in the Mediterranean Sea, *C. lampas lampas* is distributed in the western basin, *C. tritonis variegata* in the eastern. In the Gulf of Naples *C. lampas lampas* is mainly caught by fishermen on a number of offshore shoals characterized by sciophilous communities of «coralligen». Historically the species is considered uncommon in the waters of the Gulf and no evidence has arisen to warrant considering the species in danger of extinction today.

Summary

The forms of *Charonia* have been classified in two species, *C. lampas* and *C. tritonis*, widely distributed inthe tropical and subtropical waters of the world. Each species, however, has been divided into several geographic subspecies, of which *C. lampas lampas* and *C. tritonis variegata* are present in the Mediterranean Sea, where they are the largest Gastropod forms.

An analysis of records for the last 30 years clearly confirms that the two species have very different distributions in the Mediterranean. *Charonia lampas lampas* (= *nodifera*) has been exclusively found in the western basin, while *Charonia tritonis variegata* (= *seguenzae*) has been recorded exclusively in the eastern basin. The sill between Sicily and Tunisia seems to be the only zone where the distribution of the two species overlaps.

No clear niche differentiation between the Mediterranean species has yet become apparent. Specimens are mainly caught by fishermen and therefore it is very difficult to evaluate the frequency of occurrence. Direct capture by scuba divers is rare, but could provide more information on sites and on life habits. As for the Gulf of Naples, in particular, reports from fishermen and divers give a fairly good picture of the habitat and locations of the main collecting sites of *Charonia lampas*. Over the last 50 years, the species has almost completely disappeared in some polluted coastal zones, but it is still caught with a certain frequency on a few banks in the open sea.

Several aquarium observations of life habits also have yielded valuable information on the ecology of the two species. This enables more precise hypotheses to interpret their rare occurrence in Mediterranean waters.

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Riassunto

Secondo una revisione sistematica alquanto recente, il genere *Charonia* risulta essere costituito da due sole specie, *C. lampas* e *C. tritonis*, ampiamente distribuite nelle acque tropicali e sub tropicali del mondo. Tuttavia ciascuna delle due specie è stata suddivisa in diverse sottospecie, o razze geografiche. Di queste sono presenti in Mediterraneo *C. lampas lampas* e *C. tritonis variegata*, che risultano essere i Gasteropodi di maggiore taglia.

Dall'analisi delle segnalazioni di «tritoni» in Mediterraneo in questi ultimi 30 anni, chiaramente si evince che *C. lampas lampas* (= *nodifera*) è stata rinvenuta esclusivamente nel bacino occidentale, mentre *C. tritonis variegata* (= *seguenzae*) è stata rinvenuta esclusivamente nel bacino orientale. La soglia siculo-tunisina sembra esere l'unica zona di sovrapposizione degli areali di distribuzione delle due specie. Tuttavia al momento non sussistono altri elementi cognitivi sulla differenziazione delle nicchie di queste due specie in Mediterraneo.

Gli esemplari sono catturati soprattutto da pescatori e pertanto risulta molto difficile stimare la effettiva frequenza delle specie. Catture dirette da parte di subacquei sono alquanto rare, ma potrebbero essere più informative riguardo agli ambienti ed alle abitudini di vita dei tritoni nel Mediterraneo.

Per quanto riguarda in particolare il golfo di Napoli, le notizie raccolte presso pescatori e subacquei hanno permesso una ricostruzione alquanto precisa dei siti di raccolta e dell'ambiente di vita di *C. lampas lampas*. La specie già nel secolo scorso è considerata poco comune. In questi ultimi 50 anni è quasi del tutto scomparsa in alcune aree costiere fortemente inquinate, sebbene continui ad essere catturata con una certa frequenza su numerose secche del largo, caratterizzate da comunità del coralligeno. Maggiori informazioni sulle abitudini di vita della specie sono state ottenute attraverso osservazioni in acquario. Il tutto, insieme alle conoscenze sulla biologia riproduttiva, ha permesso la formulazione di ipotesi più precise riguardo alla rarità dei tritoni nelle acque del Mediterraneo.

Worldwide distribution of «tritons»

The Gastropod species of the genus *Charonia* Gistel, 1847 are known around the world and are commonly called «tritons». They are, in fact, very widely distributed, being present, or common, in all tropical and subtropical waters, with the sole exception of the Pacific coasts of America. This «cosmopolitan» distribution (probably the result of the length of their planctonic larval life), and the relative variability of some shell characteristics (such as slenderness and colour), have induced several malacologists to divide the different forms of tritons into several species of confusing and controversial distribution.

In the basic study of Beu (1970) such forms were grouped in just two species with precise biogeographic characteristics: *Charonia tritonis* (Linnaeus, 1758), of warm equatorial and tropical waters, and *Charonia lampas* (Linnaeus, 1758), of colder subtropical regions in both hemispheres. Beyond this grouping, according to this author, it is possible to distinguish some geographic subspecies, between which minor genetic interchanges can reasonably be expected to take place (Figura 1). As to the first species, populations of the tropical *C. tritonis tritonis* (Linnaeus, 1758) of the Indo-Pacific Ocean may be considered as isolated by the African continent from those of *C. tritonis variegata* (Lamarck, 1816) of the tropical waters of the Atlantic Ocean. As for the populations of the subtropical species, the boreal-Atlantic *C. lampas lampas* (Linnaeus, 1758) of the European and North-African coasts, and the boreal-Pacific *C. lampas sauliae* (Reeve, 1844) of the Japanese coasts are rather isolated by the warm equatorial waters from the austral populations of *C. lampas pustulata* (Euthyme, 1889) of the South-African coasts, *C. lampas rubicunda* (Perry, 1811) of the south Australian coasts, and *C. lampas capax* Finlay, 1927 of New Zealand waters. More recently, Beu (1985) also combined the two latter taxa, considering the populations of Australia and New Zealand as belonging to one geographic and genetic pool, *C.l. rubicunda*.

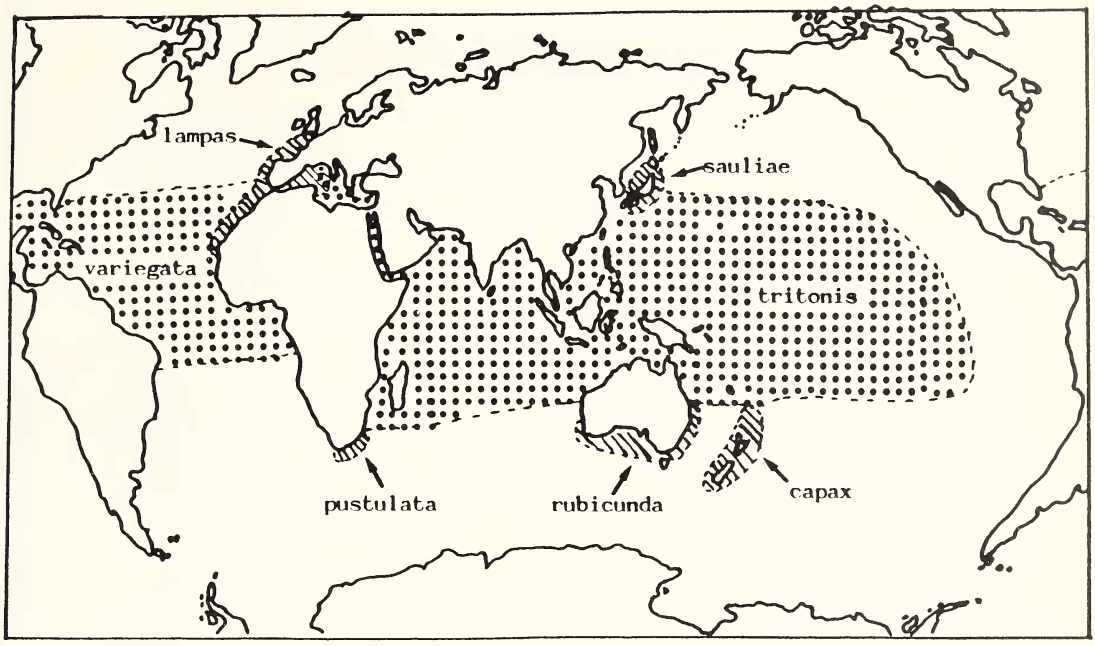

Fig. 1
Distribution of subspecies of *Charonia tritonis* (dotted area) and *Charonia lampas* (striped areas) around the world (after Beu, 1970).

The distribution of «tritons» in the Mediterranean Sea

Tritons are the largest Gastropods in the Mediterranean Sea and are historically well known to fishermen and naturalists. They are recorded in all ancient and modern faunistic and taxonomic publications and reviews on Mediterranean mollusc fauna (e.g. Monterosato, 1878; Bucquoy et al, 1882; Carus, 1889; Hidalgo, 1917; Priolo, 1960; Nordsieck, 1968; Parenzan, 1970; Settepassi, 1967). Since captures have been considered sporadic and therefore noteworthy, it has been possible to investigate the actual presence and the distribution of these species by analysing records of the last 30 years (Figure 2).

Results confirm that in the Mediterranean both species of tritons are present. Yet, these results strongly suggest clear differences in the geographical distribution of the two species, following the same pattern, on a smaller scale, as that observed in the Oceans. In fact, the «cold» species *C. lampas lampas* (= *nodifera*) was recorded exclusively in the Western basin, while the «warm» *C. tritonis variegata* (= *seguenzae*) was recorded exclusively in the eastern basin. The sill between Sicily and Tunisia seems to be the only geographical area where the distribution of the two species overlaps. The presence of *C. lampas lampas* along the coasts of the island of Cyprus (Demetropulos, 1969; Tornaritis, 1987) is uncertain as the provenance of the shells in the collections are supposed.

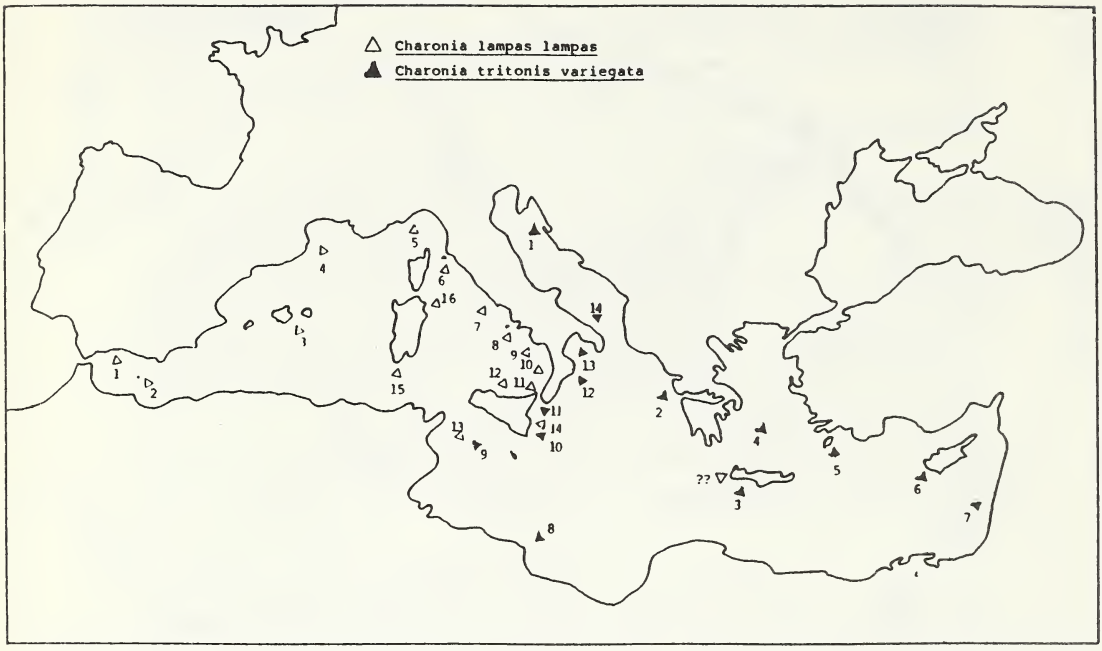

Fig. 2
Distribution of records of *Charonia* species in the Mediterranean Sea (last 30 years). Numbers are according Tab. 1 and Tab. 2.

In any case, most of specimens are caught by fishermen and the shells used as knicknacks or «trumpets»; therefore it is virtually impossible to assemble precise and complete information on the distribution and abundance of the two species in the Mediterranean Sea. Direct captures by scuba divers are rare but generally better recorded in literature, and these give useful information on the depth and the habitat where the specimens lived (see Tables 1, 2).

Some noteworthy considerations arise from an analysis of the *Ch. lampas lampas* records: the depth of most of the findings seems to increase eastward, while the abundance of the populations seems to decrease. The result seems to be a sort of gradual transition from abundant populations in shallow waters (0-20 m of depths) in the Alboran Sea to isolated specimens in deeper waters (20-40 m) in the Tyrrhenian Sea. Rare specimens at depths of more than 100 m have been collected throughout the western basin of the Mediterranean Sea.

As for *Ch. tritonis variegata*, most of the records for the eastern basin of the Mediterranean are from shallow waters (0-10 m in depth). No precise information is available on abundance of the populations.

TAB. 1

Mediterranean records of *Charonia lampas lampas*

1 - *Southern coasts of Spain*			
Franchini, 1974	23m		abundant
Luque, 1986 (Bay of Malaga)	4-20m	rocks on sandy bottom	abundant
2 - *Alboran island*			
Salas & Luque, 1986	0-20m	rocks	abundant
Templado et al., 1986	70-120m	coralligen	
3 - *Baleares islands*			
Anonymous, 1988 (Majorca)	90m	(fishermen)	1 specimen
4 - *Southern coasts of France*			
Amouroux, 1974 (Cape L'Abeille)	35m	coarse sand and coralligen	1 specimen
5 - *Ligurian coasts*			
De Longis, 1987 (S. Lorenzo, Imperia)			1 specimen
6 - *Tuscan coasts and islands*			
Barsotti & Frilli, 1969 (Livorno)	50-100m	coralligen («macciottito»)	quite common
Terreni, 1981 (Meloria)	15m		1 specimen
Terreni, 1981 (Capraia, Elba)		(fishermen)	
Mojetta, 1982	45m		1 specimen
Anonymous, 1988 (Piombino channel)	35m	detritic mud (fishermen)	1 specimen
7 - *Coasts and islands of Lazio*			
Oliverio & Villa, 1985 (Fiumicino)		coralligenous rocks	rare
Sansone, c.p. (Ventotene, Ponza)			
8 - *Gulf of Naples (see also the table apart)*			
Federico & Tripodi, 1967 (Capri)	20m	coralligen, detritic sand	1 specimen
9 - *Cilento coasts*			
Berardelli, c.p. (Castellabate)	offshore	(fishermen)	quite common
Parlato, c.p. (Acciaroli)		(fishermen)	1 specimen
10 - *Tyrrhenian coasts of Calabria*			
Gatti, c.p. (Capo Rizzuto)	30-40m	on shoals (fishermen)	quite common
11 - *Strait of Messina*			
Micali & Giovine, 1983	30m	coarse and	1 specimen
12 - *Northern coasts of Sicily*			
Parenzan, 1970 (Milazzo, Vulcano)			1 specimen
Chemello, 1986 (Ustica)			
13 - *Channel of Sicily*			
Angeletti, 1968 (Lampedusa)	100m		1 specimen
Anonymous, 1971 (Lampedusa)	100m		1 specimen
Sabelli & Spada, 1982	60m		quite common
14 - *Eastern coasts of Sicily*			
Anonymous, 1971 (Siracusa)			
Mannucci, 1983 (Acitrezza)			1 specimen
15 - *Southern Sardinia*			
Ambrosini & Silesu, c.p. (Cagliari)	offshore	(fishermen)	some specimen
Ambrosini & Silesu, c.p. (Capo Teulada)	offshore	(fishermen)	quite common
Concas, c.p. (Buggerru)	offshore	(fishermen)	some specimen
Turella, c.p. (Villasimius)	offshore	(fishermen)	some specimen
16 - *North-Eastern Sardinia*			
Settepassi, 1967 (Maddalena)			1 specimen
D'Angelo & Gargiullo, 1982 (Maddalena)			1 shell
?? - *Cyprus island*			
Tornaritis, 1987			from collection
Demetropulos, 1969			from collection

TAB. 2

Mediterranean records of *Charonia tritonis variegata*

1 - *Dalmatia coasts and islands*			
Spada, 1973 (Cajola island)	6m	rocks with algae	1 specimen
Spada, 1973 (Lissa island)	8-10m	rocks	1 specimen
Mel, 1976 (Cazza island)	7m		5 specimens
Mel, 1976 (Dugi Otoc island)	15-18m	rocks	2 specimens
2 - *Western coasts and islands of Greece*			
Makris, 1965 (Antipaxos island)	8-10m	rocks	2 specimens
Ghisotti, 1971 (Cefalonia island)	10-15m	rocks	abundant
Martino, 1973 (Gulf of Astakos)	1-6m	rocks and Posidonia	2 specimens
Perna, c.p. (Corfù island)			1 specimen
3 - *Crete island*			
Makris, 1965			
Sabelli & Spada, 1982	7m		
4 - *Cicladi islands*			
Makris, 1965			
Barletta, 1969	15m	corraligen	3 specimens
5 - *Rhodes island*			
Anonymous, 1971			shell
Barletta, 1969b	3m		2 specimens
D'Angelo & Gargiullo, 1982			shell
6 - *Cyprus island*			
Clench & Turner, 1957 (Limassol)			shell
Tornaritis, 1987 (Akamas)			1 specimen
Zambakides, c.p. (Aypa Napa)			some specimens
7 - *Coasts of Lebanon and Israel*			
Clench & Turner, 1957 (Lebanon)			
Spada, 1971 (Lebanon)	4-6m	rocks	1 specimen
Barash & Danin, 1982 (Lebanon, Israel)	2-8m		common
8 - *Coasts of Libya and Tunisia*			
Barletta, 1969			abundant
9 - *Channel of Sicily*			
Paccagnella, 1967 (Lampedusa island)	30m	rocks and sand	1 specimen
Paccagnella, 1967 (Banco Mezzogiorno)	30-40m	(fishermen)	common
10 - *Eastern coasts of Sicily*			
Priolo, 1964 (Catania, Siracusa)			common
Anonymous, 1971 (Siracusa)			shell
11 - *Strait of Messina*			
Micali & Giovine, 1983 (Faro)			
12 - *Ionian coasts of Calabria*			
Villani, c.p. (Crotone)			
13 - *Gulf of Taranto*			
Melone & Garavelli, 1970 (Tarnto)	8m	precoralligen	1 specimen
Melone & Garavelli, 1970 (Porto Cesareo)			shell
14 - *Italian coasts of South Adriatic*			
Barletta, 1969a (Brindisi)	8m	rocks	shell
Mel, 1976 (Otranto Channel)			

The presence of «tritons» in the Gulf of Naples

Charonia lampas lampas (= nodifera) is the triton present in the Gulf of Naples. Since the last century, it has been considered «rather rare», and living on hard or coarse detritic bottoms colonized by calcareous algae at depths of from 30 to 150m (Von Salis, 1793; Scacchi, 1836; Philippi, 1836; Lo Bianco, 1888; Bellini, 1901, 1929; Praus Franceschini, 1906).

In his study on «The submarine fauna of the Gulf of Naples», performed on a total of 154 samples collected by a dredge, Colombo (1887) found just one specimen of «tritonium nodiferum» (in a sample from the waters near Capri). Yet, in the first half of this century the species was also recorded on the shoals («secche») of «Chiaia» (Ranzi, 1930) and of «Benda Palummo» (Bacci, 1947).

TAB. 3

Records of *C. lampas lampas* in the Gulf of Naples in recent years

Secca Gaiola
25m, on coarse detritic sand («SGCF» sensu PÉRÈS & PICARD, 1964), among rocks colonized by «coralligen» communities (SANSONE p.c., by scuba diving): 1 specimen.

Trentaremi (La Badessa)
25-30m, on rocks colonized by communities of «coralligen» (SANSONE p.c., by scuba diving): 1 specimen.

Pozzuoli
40m, on coarse sand and rocks (fishermen by fixed net): 1 specimen.

Procida island
25-30m, P.ta Pizzaco, on rocks colonized by communities of «coralligen» (SANSONE p.c., by scuba diving): 1 specimen.
30-35m, P.ta Pizzaco, on rocks colonized by communities of «coralligen» (anonymous diver): 1 specimen. 120m, on detritic mud (fishermen by fixed net): 1 specimen.

Capo Posillipo
20-25m, on coarse detritic sand (SGCF) (fishermen, by trawl net called «gangano»): 2 specimens.

Banco d'Ischia
30-40m, on rocks colonized by «coralligen» communities or *Posidonia oceanica* shoots (fishermen, by fixed net called «tramaglio»).

Sorrentine Peninsula
20m, 1 specimen, on detritic mud (fishermen by fixed net, PARLATO, c.p.).

Island of Capri
30-40m, on coarse detritic-sand (fishermen, by fixed net or by trawling; about 5 specimen in one year, PARLATO, c.p.).

Information on the occurence of the species in recent years has been collected from fishermen and divers (see Table 3). According to the fishermen, specimens have also been collected on the rocky or detritic (biogenic coarse-sandy) bottoms facing the coast of Posillipo, on the neighhouring shoals of Gaiola and Nisida, and along the «ciglio» (terrace of rocks and eroded *Posidonia* «matte») facing Pozzuoli. Yet, today *C. lampas* is becoming rarer in these zones and has completely disappeared in the most polluted, inner parts of the Gulf, such as the basin of Pozzuoli. The main sites of sporadic capture remain the unpolluted rocky coasts and islands delimiting the outer part of the Gulf, such as the Sorrentine peninsula, the islands of Capri, Procida and Ischia, and especially the unpolluted offshore shoals such as «Banco d'Ischia», «Catena», «Miseno», «Benda Palummo» (Figure 3).

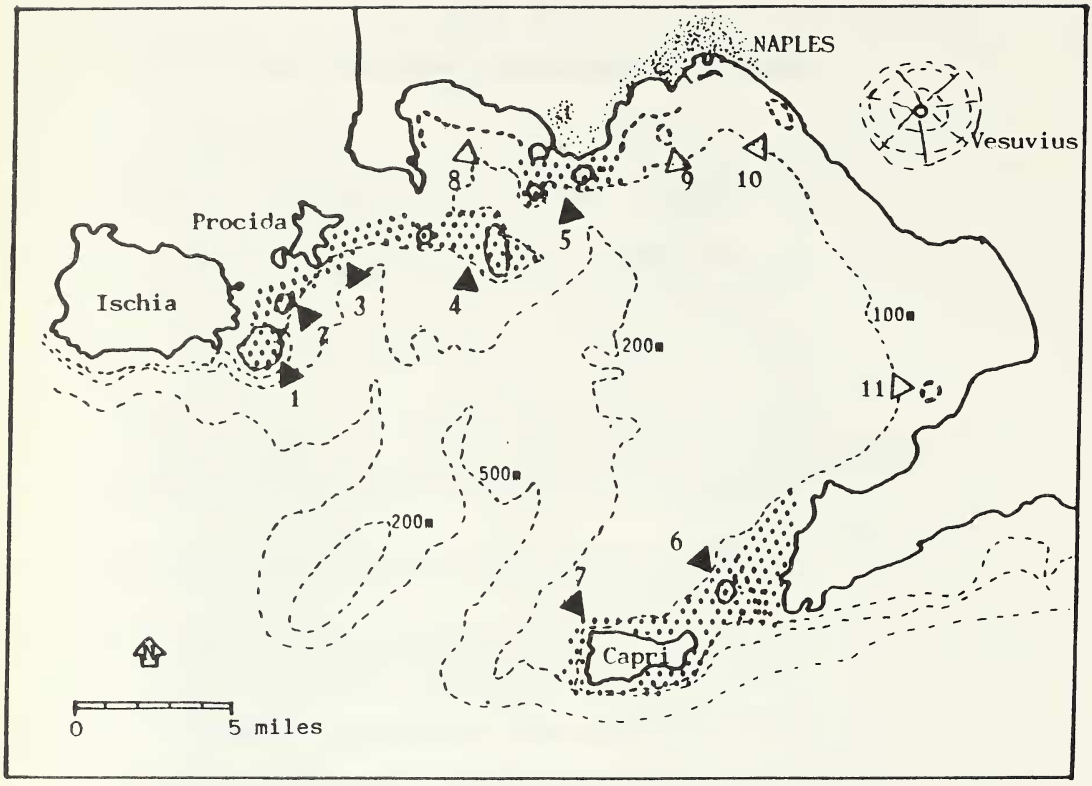

Fig. 3
Probable distribution of *Charonia lampas* in the Bay of Naples (see also Tab. 3).
— Dotted zones and black arrows show the outermost part of the Bay where the specimen are mainly catched: (1) Ischia Bank; (2) Catena shoal; (3) Procida island; (4) Tauben Bank (Miseno and «Benda Palummo» shoals); (5) Posillipo Cape, Trentaremi cove, Nisida and Gaiola shoals; (6) Punta Campanella and Bocca Piccola shoal; (7) Capri island.
— White arrows and hatched lines show the innermost part of the Bay, where the species is almost disappeared: (8) «ciglio» off Pozzuoli; (9) coast and shoal off Chiaia; (10) shoal off S. Giovanni; (11) shoal off Vico Equense.

According to fishermen, specimens are mainly collected by gill nets («tramagli»), seldom by fishpots («nasse») or by trawling, and almost exclusively at night. The bottoms are mainly characterized by scattered rocks or irregular patches of the seagrass *Posidonia oceanica* (lower limits of the beds) and by coarse sand.

The very rare findings by divers allow direct observations of the habitat and life habits of the species. Specimens have been observed always during the day, at a depth of 25-30m, motionless and hidden in cavities, among rocks colonized by sciophilous communities of «coralligen» (sensu Pérès & Picard, 1964), often in proximity to sandy bottoms.

Ecological considerations for mediterranean tritons

Tritons are gonocoric species, with males possesing a well developed penis. The only information available on the period of reproduction in the Mediterranean Sea is that reported by Lo Bianco (1888). The author observed, in an aquarium of the Zoological Station of Naples, some specimens of *Ch. lampas* coupling two times during a year, in Dicember and June. In the same months he observed egg deposition, of which he gives an accurate description. The eggs are abundant and enclosed in numerous club-shaped capsules (some hundreds of eggs per capsule). However, some authors (Amouroux, 1974) have observed aquarium spawning to be induced by the quality of food, in particular after feeding a particular type of prey (iiei the seastar *Echinaster sepositus*).

The larval stage of tritons, on the contrary, has been observed thoroughly. Tritons are, in fact, among the few species of marine molluscs that have a planctonic, long-term, free-swimming larva («teleplanic» according to Scheltema, 1971a). The pelagic stage can last several months and this characteristc of the life cycle allows a wide dispersal of the species, with strong genetic interchanges even between distant populations. This characteristic can explain the oligotypy of the genus *Charonia* and its circumtropical distribution (cfr. Scheltema, 1971b, 1978).

Yet no information is available on the distribution of triton larvae in the Mediterranean Sea. Probably larvae of tritons from Atlantic populations of both *Charonia* species are introduced in the basin through the Straits of Gibraltar. However, abundant and stable populations, in which the probability of encounter and coupling between males and females is high, can be assumed at least for *Charonia lampas* in the Alboran Sea (Templado, 1990). It is highly probable that abundant and stable populations of *Ch. tritonis* may also be present in the Eastern basin (Ghisotti, 1971; Tenekidis, 1989) although at the moment there is no clear evidence.

Theoretically, the reproductive potential is so high, and the dispersion capacity of the larvae so wide, that sporadic records of tritons in the Mediterranean Sea could be explained without hypothesizing the presence of reproductive populations in the basin. In any case, scattered and isolated specimens could derive from alloctonous larvae, and this is probably the case in several colder areas of the Mediterranean.

The abundance of populations is very difficult to evaluate, due to the peculiarity of the life habits of these molluscs. Fishermen's accounts (see above) and aquarium observations (e.g. Mojetta, 1981; Bentivegna et al., 1989) offer evidence in support of the sciophily of the tritons. They are quiescent and hidden in the shadowed cavities of the rocks during the day, and are thus very hard for divers to see, and therefore to catch. Moreover the shell is mimetic; it looks a stone, often encrusted by calcareous algae, sponges and briozoans. The tritons actively move for predation during the night, when they are sometimes caught in fishing gear.

Records on the types of bottoms where the tritons live are not homogeneous. Divers mainly see them during the day, on hard bottoms colonized by the sciophilous communities of «coralligen» or «precoralligen»; on the other hand, fishermen mainly catch them during the night, on soft bot-

toms. Probably the preferential habitat of the species is the «interface» between soft and hard bottoms, such as the deep limits of *Posidonia* beds or «intermatte» channels, or where rocks emerge from soft bottoms at the base of steep cliffs or rocky shoals.

The hypothesis of such an «interface» habitat agrees well with what is known of the species' feeding habits. In fact, according to recent literature (Amouroux, 19874; Mojetta, 1981; Bentivegna et al., 1989), tritons preferentially prey upon populations of *Echinaster sepositus*, the only mediterranean sea-star of a family abundant and widely distributed in the tropical Indo-Pacific and Atlantic (Tortonese, 1954), which can be considered for Mediterranean tritons a sort of «trophic memory» of the main sites of their origin. The sea-star, in turn, mainly feeds on sponges of different genera (*Axinella, Leucandra* etc.) that strongly characterize the sciophilous communities («precoralligen» and «coralligen») of rocky bottoms, *Posidonia* seagrass beds and coarse detritic sands or muds, rich in stones (Tortonese, 1971). Yet, field observations (Kisch, 1949a, 1949b, 1952) and aquarium experiments (Amouroux, 1974; Mojetta, 1981; Bentivegna et al., 1989) also have stressed that, lacking *Echinaster sepositus* specimens, tritons could prey upon a variety of Mediterranean Echinoderms, both of hard bottoms, (mainly sea-stars, such as *Ophidiaster ophidianus, Coscinasterias tenuispina, Marthasterias glacialis*, and sea-urchins, such as *Paracentrotus lividus*) and of soft bottoms (mainly sea-stars, such as *Astropecten aranciacus* and sea-cucumbers, such as *Holoturia forskali*). A scavenger activity cannot be excluded, considering that some specimens have been caught in fishpots baited with remains of fishes, and some aquarium specimens have been fed remains of fishes, crustaceans and molluscs.

Therefore, it is likely that tritons at night leave their rocky shelters and actively move on the surrounding soft and hard bottoms for predation of the slow moving Echinoderms.

Most of the previous considerations take into account knowledge and reports of *C. lampas lampas*. Similar life habits for *C. tritonis variegata* in the Mediterranean Sea could be hypothesized, since the difference in water temperature is the only niche element that has so far been taken into account to distinguish the ecology of the two species of tritons. Nor are differences in life habits between them described in the literature on the tropical waters forms. Most of the papers, in fact, regard the geographical subspecies of *C. lampas* (e.g. Laxton, 1971), and a few papers on *C. tritonis* deal largely with its role as a predator on the «reef killer» sea-star *Acanthaster planci* (e.g. Schoenberg, 1966; Richards, 1985). More research on the ecology especially of *C. tritonis* is needed to enable a more precise analysis of probable niche differentiations. This would provide a better understanding of the role of triton species in the waters of the world. The Mediterranean Sea could be an ideal field for investigation, since it reproduces on a small scale the geographic features of the two species' global distribution.

Are mediterranean tritons in need of protection?

The rare occurrence of tritons in several places in the Mediterranean has not escaped the notice of environmental activist groups. These associations have characterized divers as irresponsible collectors of triton shells, and have mantained that such collecting is the main cause of the gradual «extinction» of these species in the basin.

In the light of the above observations on the ecology of the *Charonia* species in the Mediterranean environment, it is clear that these associations have identified a false problem. Several points contradict the «extinction by scuba catching» hypothesis:

— The species have been considered rare in several places along the Mediterranean coast (especially in the northern regions) since the last century, when problems of pollution and the impact of human activities had not yet arisen. It is more probable that the Mediterranean has always been at the limit of the distribution area of these tropical species;

— The cryptic and sciophilous character of the tritons' life habits and the depth of a great part of their preferred life environments («coralligen») along the Mediterranean coasts are very strong limiting factors to catching activity by scuba divers;

— In any case, the high reproductive potential (r-strategy), assuring a great number of long-living pelagic larvae that can colonize very wide areas, is a strong biological «protection» against extinction.

The scarcity of Mediterranean triton species cannot be seen as evidence of danger of extinction, nor can it be considered a result of the pressure of human catching. Any potential danger of extincion must be considered in the light of the overall equlibrium of Mediterranean coastal environments. Without generally «healthy» ecological conditions, in fact, even such cosmopolite species as tritons can disappear, together with the overall environmental system to which they belong, complex and rich in life forms (many of which really are in danger of extinction, because they are endemic). The case of the innermost, very polluted area of the Gulf of Naples is a paradigmatic example.

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